

Restoring Banksia Woodland: Setting Criteria, Managing Problems and Comparing Methods

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Department of
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Ministerial Statement

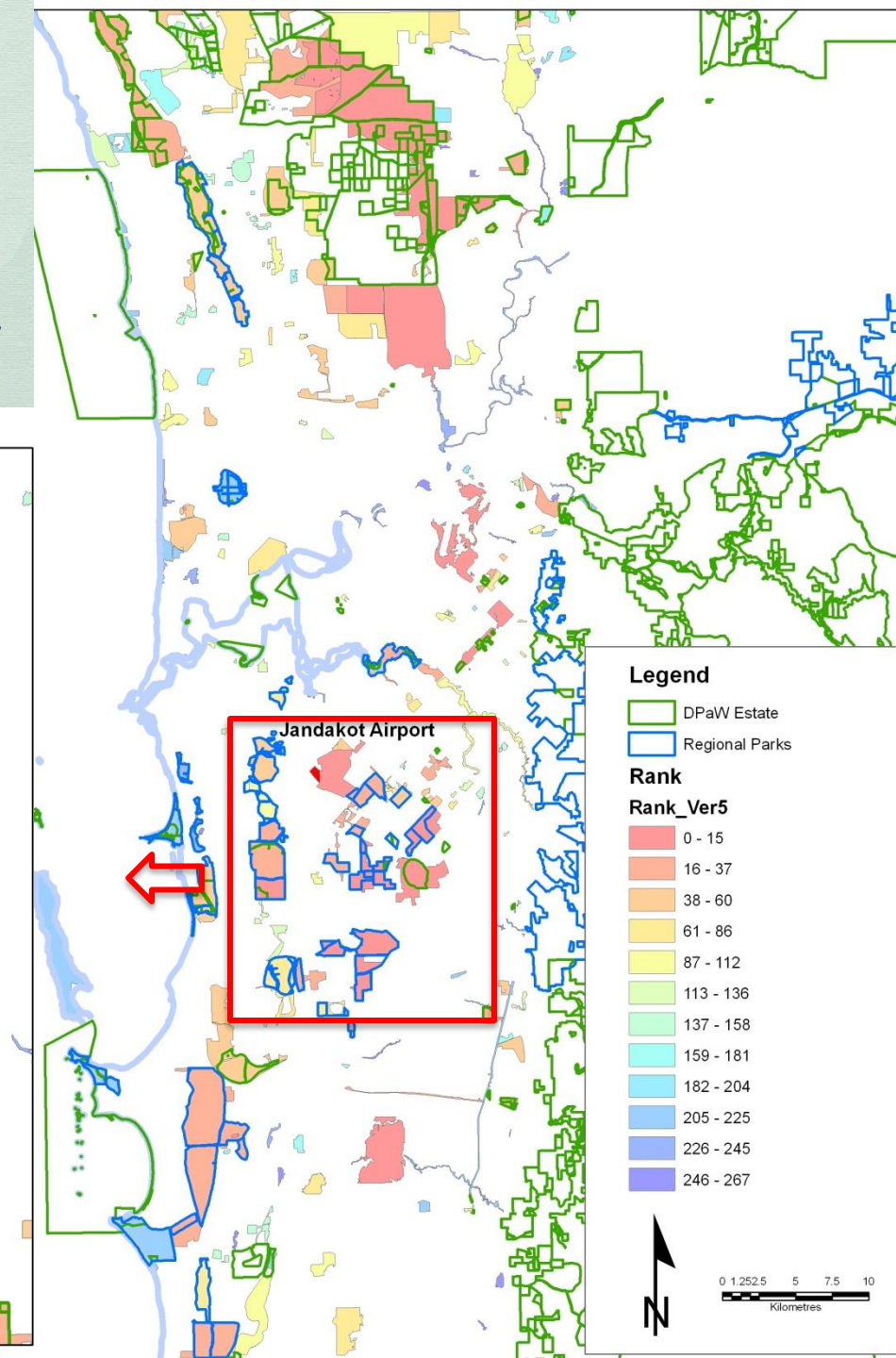
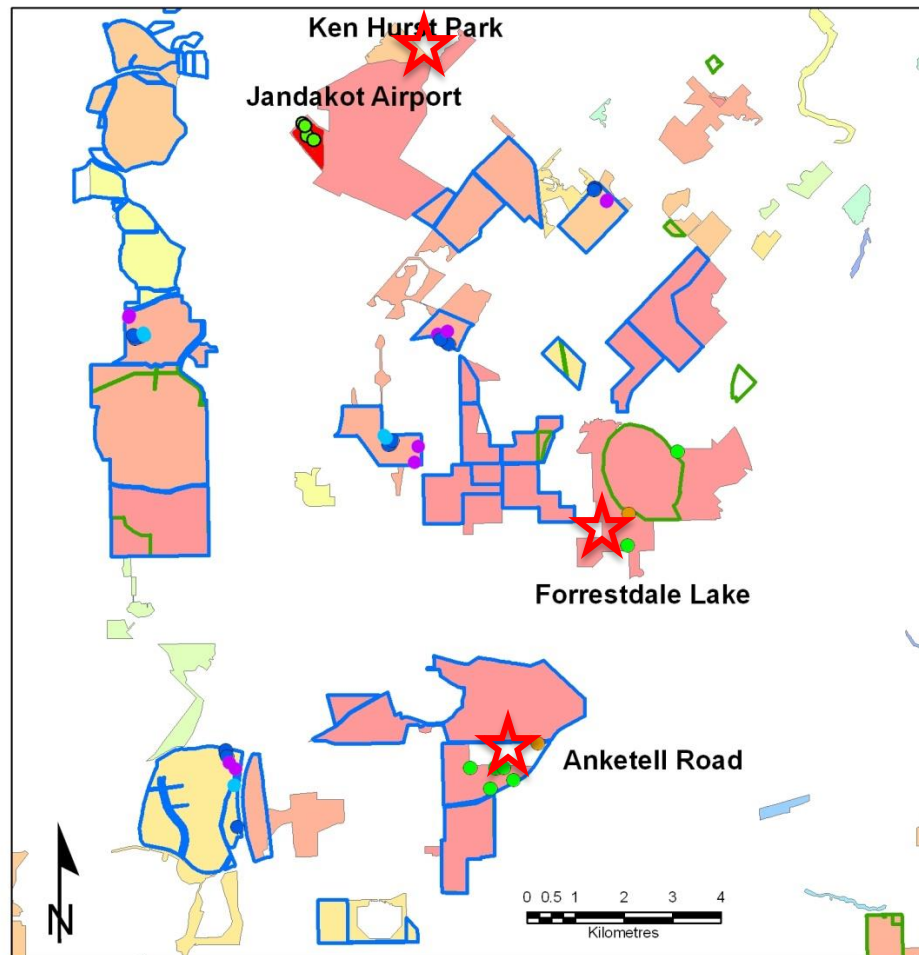
The approval for the expansion of Jandakot Airport is subject to a number of conditions, specified in the EPBC 2009/4796 approval document, but only Condition 4 b is relevant to this project.

... the person taking the action must provide to the Western Australian Department of Environment and Conservation the sum of \$9.2 million and topsoil from the Jandakot Airport lease site for use in the rehabilitation and conservation of banksia woodland at an alternative site or sites. The areas to be rehabilitated or conserved must be within 45 kilometres of the Jandakot Airport lease site unless the Minister agrees to alternative siting. The transportation costs for the topsoil are to be paid for out of the \$9.2 million. The funding must be provided in proportion to the area cleared each year, and the entire sum must be provided within a maximum of five years from commencement.'

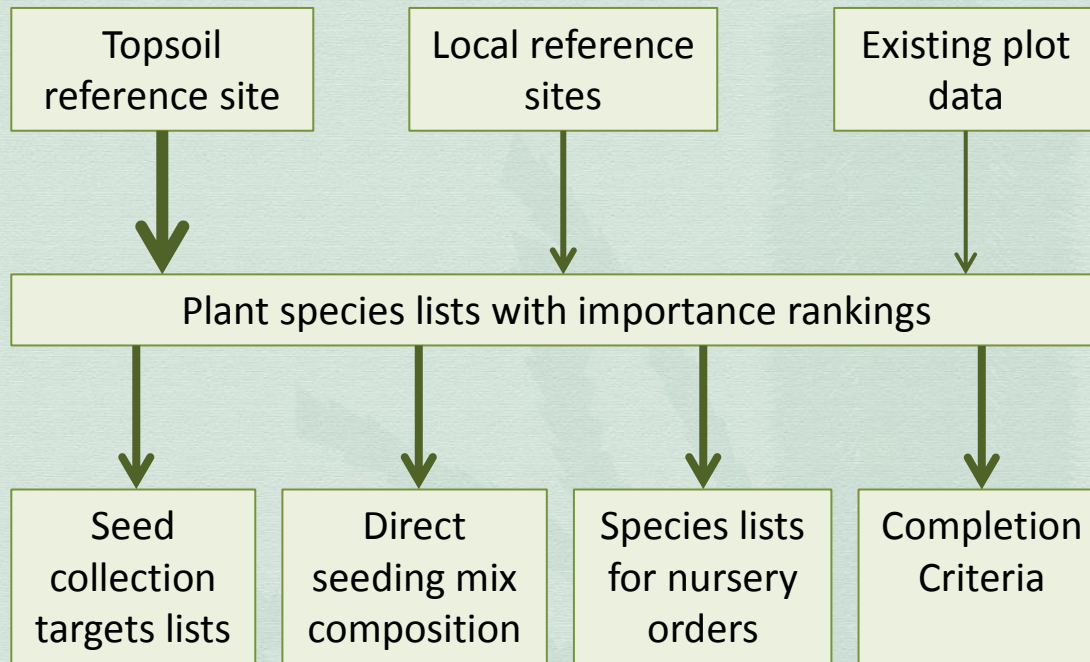
Objectives

- Restore and manage banksia woodland
- Select sites using rigorous ranking process
- Use scientific approaches and evaluate relative effectiveness of methods
- Maximise area restored or managed
- Develop monitoring protocols
- Support community groups and land managers
- Collate and share information

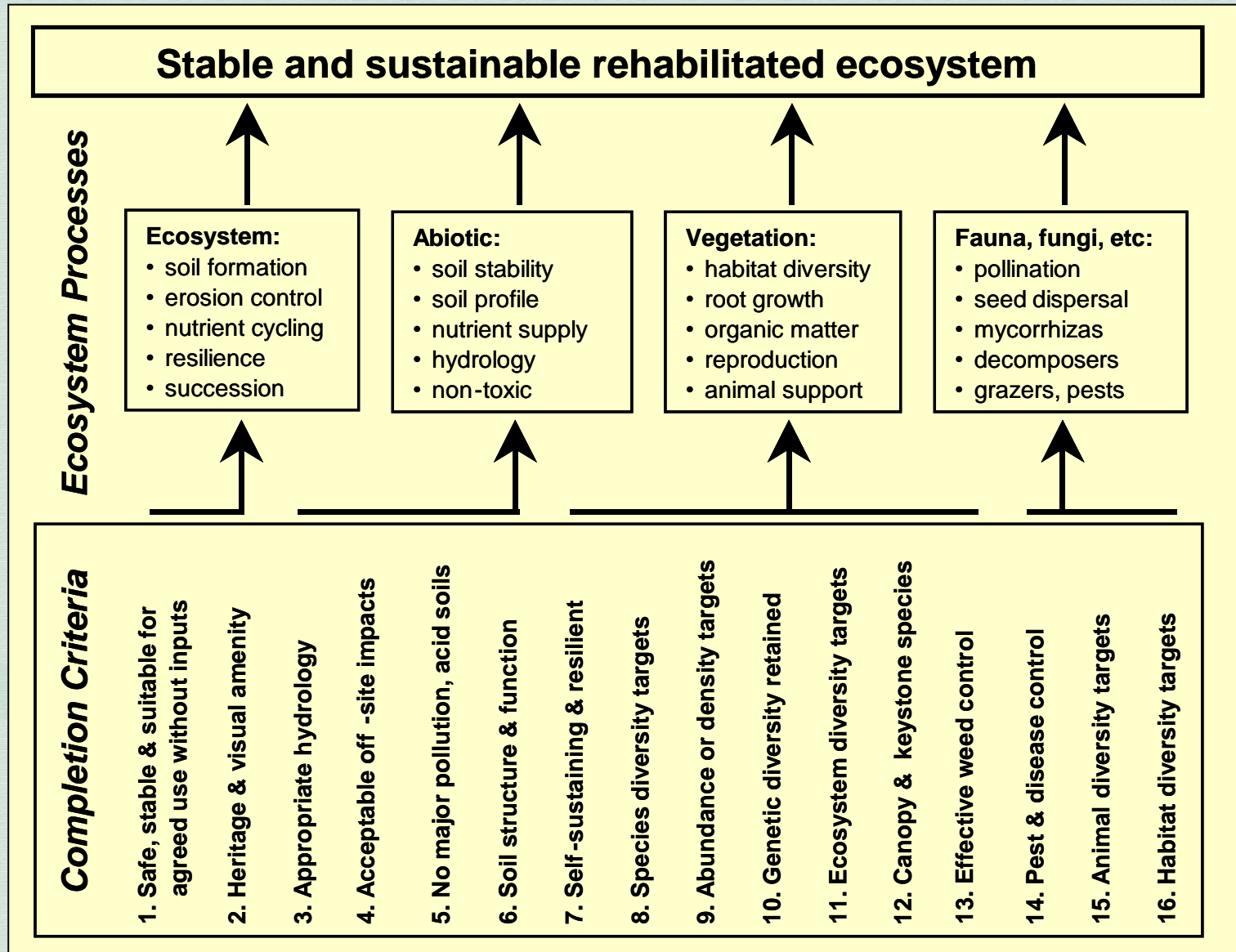
Ranking Bush Forever Sites Significance and Similarity



Use of Reference Site Data in Restoration



Standard Completion Criteria



Setting Completion Criteria

Criteria	Target
1. Total species richness	Maximise native species richness
2. Average species richness per area	Return 60% of native plants recorded in reference quadrats (10 x 10 m)
3. Tree diversity	Presence of all trees at reference plots
4. Tree density	Establish at least 300 stems/ha
5. CBC food plants	For banksias - 250 stems per ha
6. Understorey species richness per area	Return 60% of native understorey plants in reference quadrats (10 x 10 m)
7. Total density of native perennial plants	7,000 stems/ha
8. Annual native plants	No target set
9. Key understorey species	10 most important species in reference plots
10. Weed cover	Manage weeds effectively



Topsoil Harvesting & Transfer 2012



Nursery Management



Planting Days With BirdLife Australia



Direct Seeding by Machine & Hand

- Comparison of cost effectiveness relative to planting or topsoil transfer underway



Restoration Outcomes: Species Richness

Reference ecosystem	Status in 2016
78 species present in 12 reference quadrats	160 native species in total



Native Species (top 100)





From Topsoil

84 species

Planted Tubestock

25 species

- *Nuytsia floribunda*
- *Xanthorrhoea preisii*

Direct Seeded

33 species

Hand seeding only:

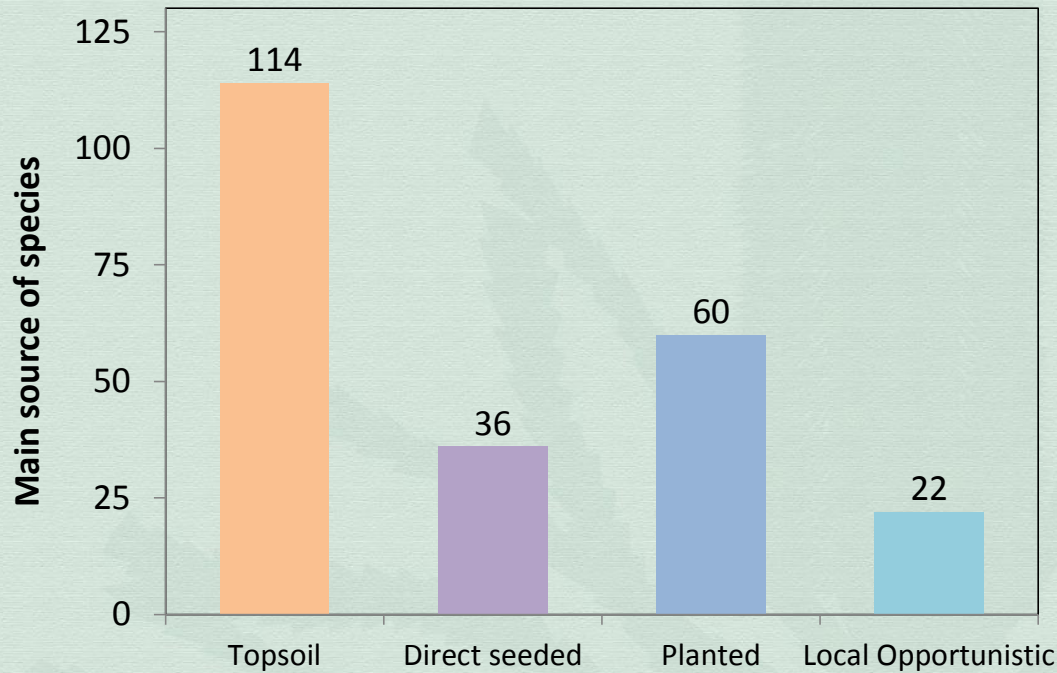
- *Macrozamia riedlei*
- *Austrostipa flavescens*
- *Xanthorrhoea preissii*
- *Nuytsia floribunda*
- *Everlastings*

Local Opportunists

16 species



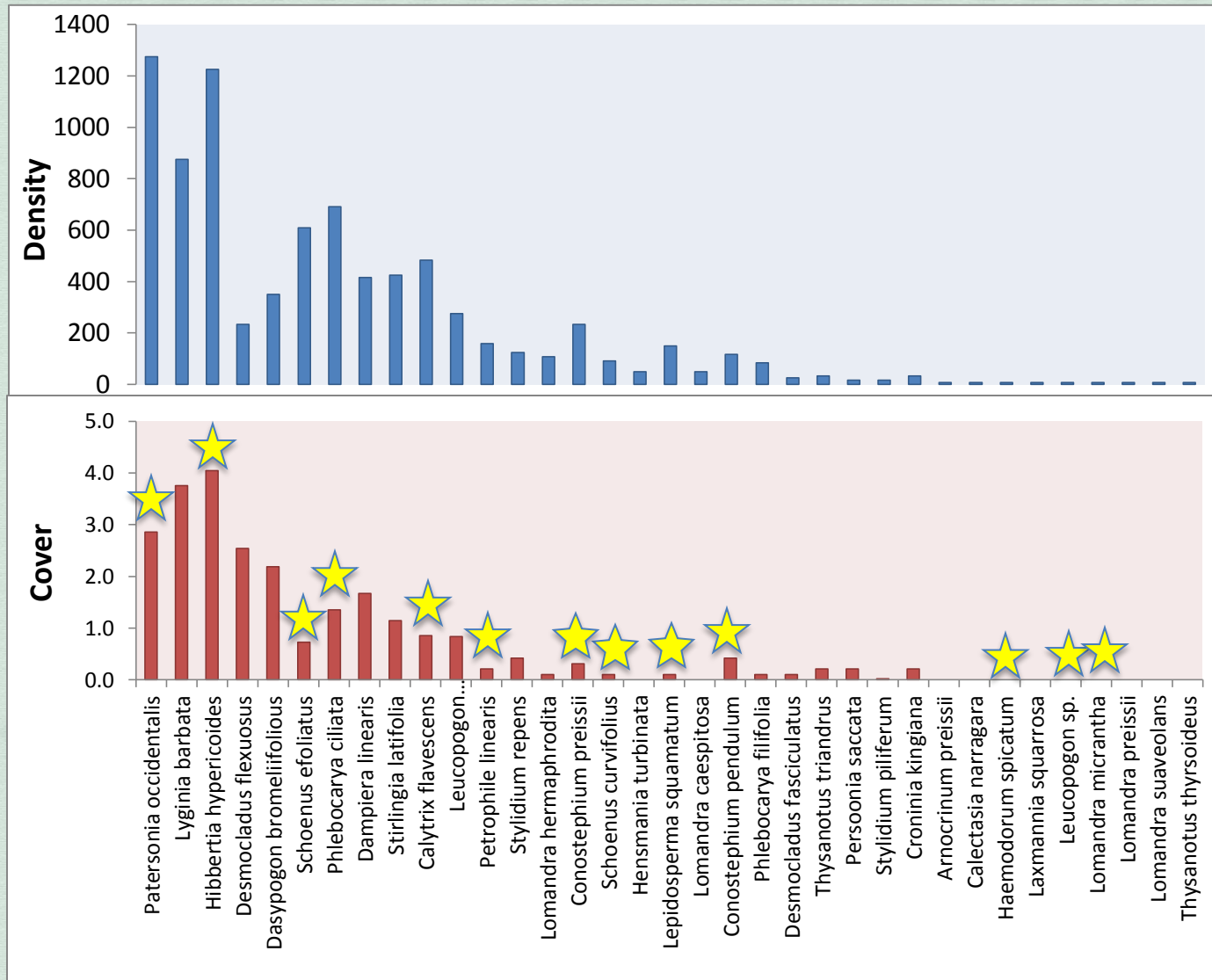
Restoration Outcomes: Sources



- 160 native plant species by year 4
- Continuum from opportunist to recalcitrant species

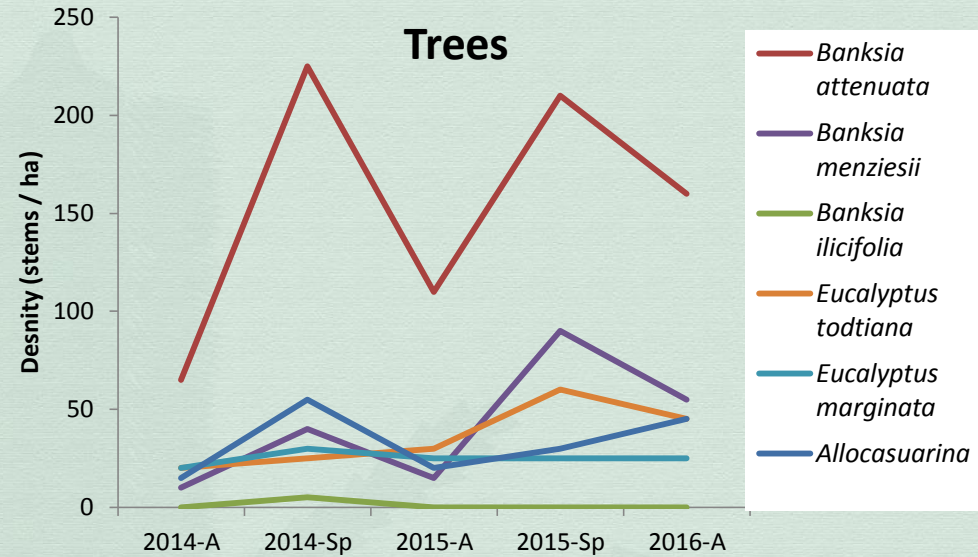
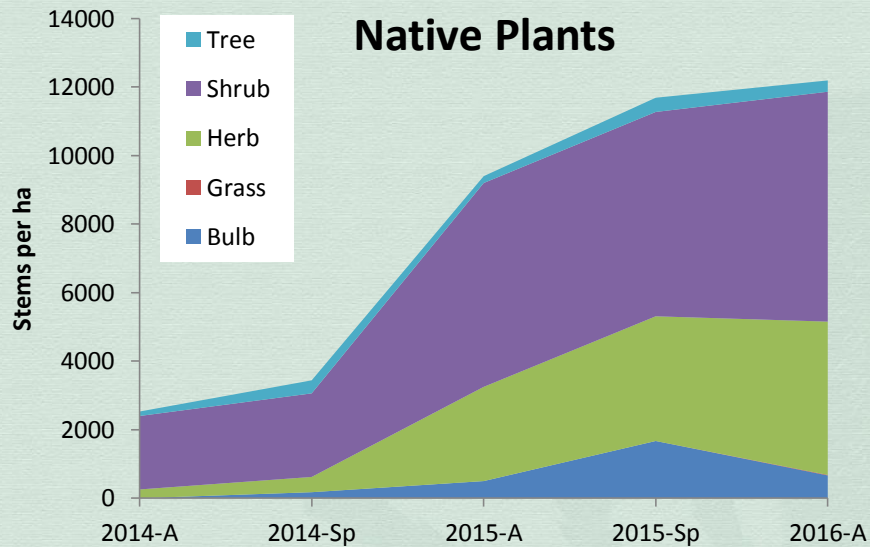


Some Species are Uncommon or Missing



Rare from topsoil (reference site cover & density)

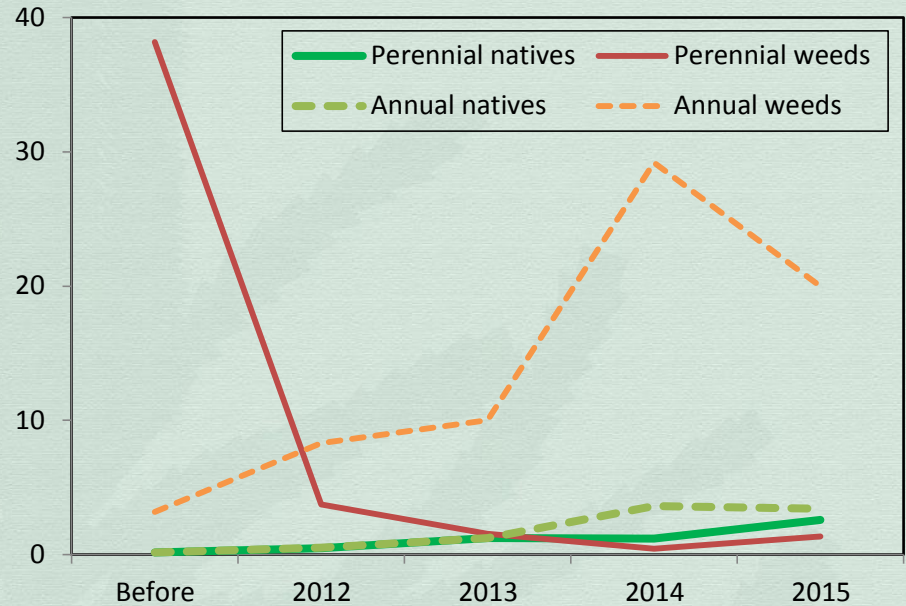
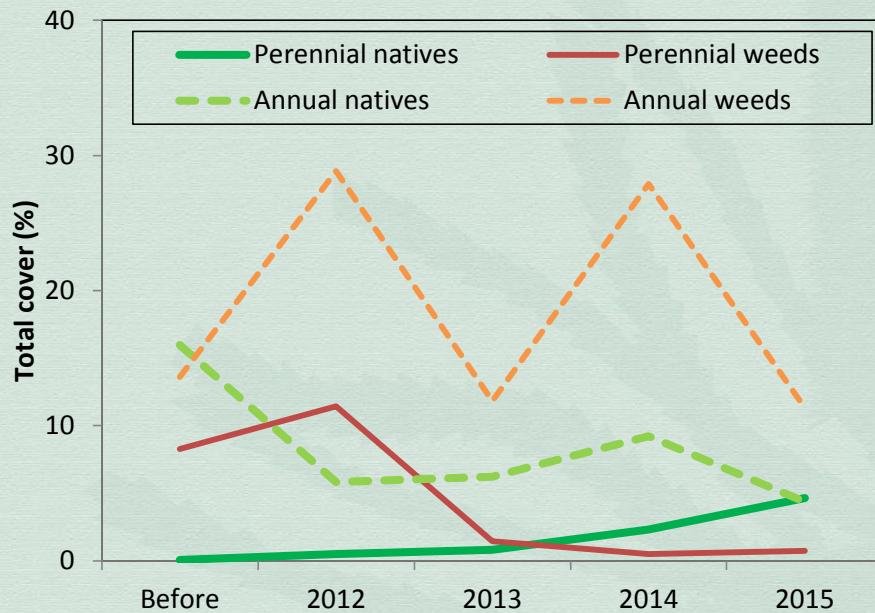
Restoration Outcomes: Density



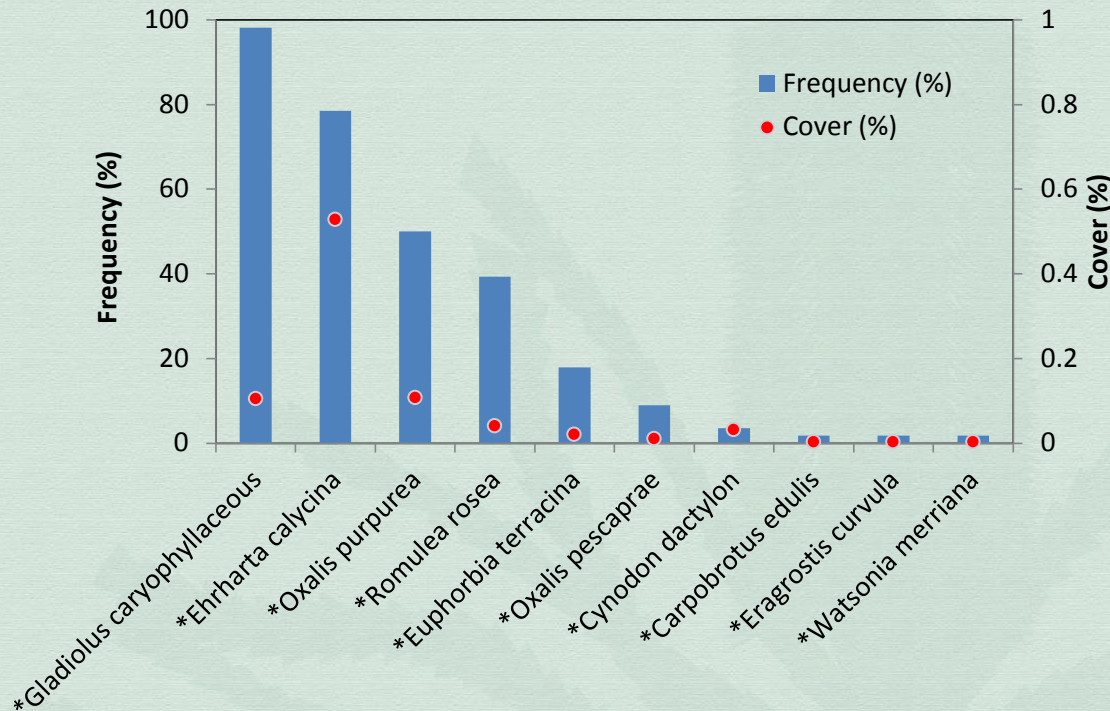
The average density of all native plants and weeds at 8 areas in the Anketell Road and Forrestdale Lake restoration sites measured in October 2015 (data from 80 plots of 5 x 5 m). These results do not include seedlings, annual natives or weeds.

Plant Cover

Criteria	Target	Status in late 2015
All native perennial plants	7,000 stems/ha	24,000 - 31,000 per ha
Annual Natives	No target set (very much lower in reference sites)	Density >500,000 stems per ha Cover 5-10 %



Restoration Outcomes: Weeds

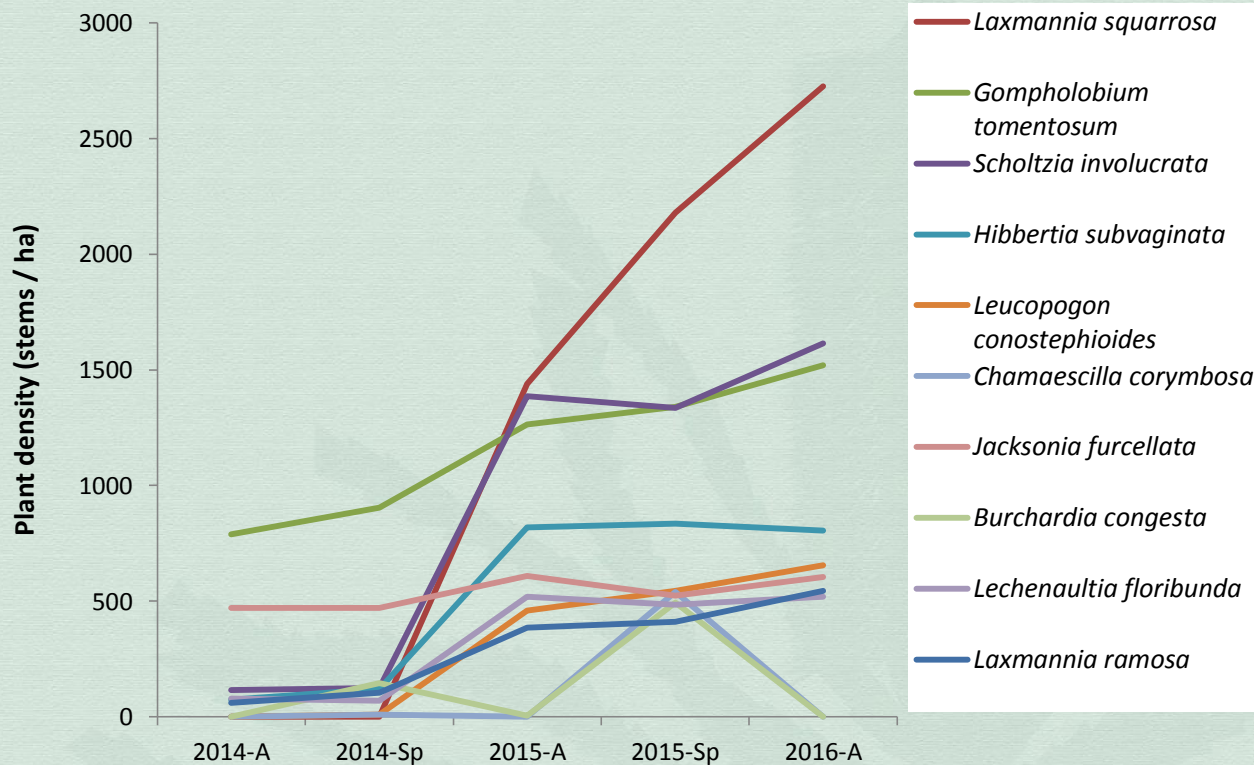


Some perennial weeds are common but have low cover (all $< 1\%$).

Annual weeds are more frequent and have higher cover.

Anketell Road in 56 - 5 x 5 m quadrats in spring 2015. Red dots show total cover (scale on right).

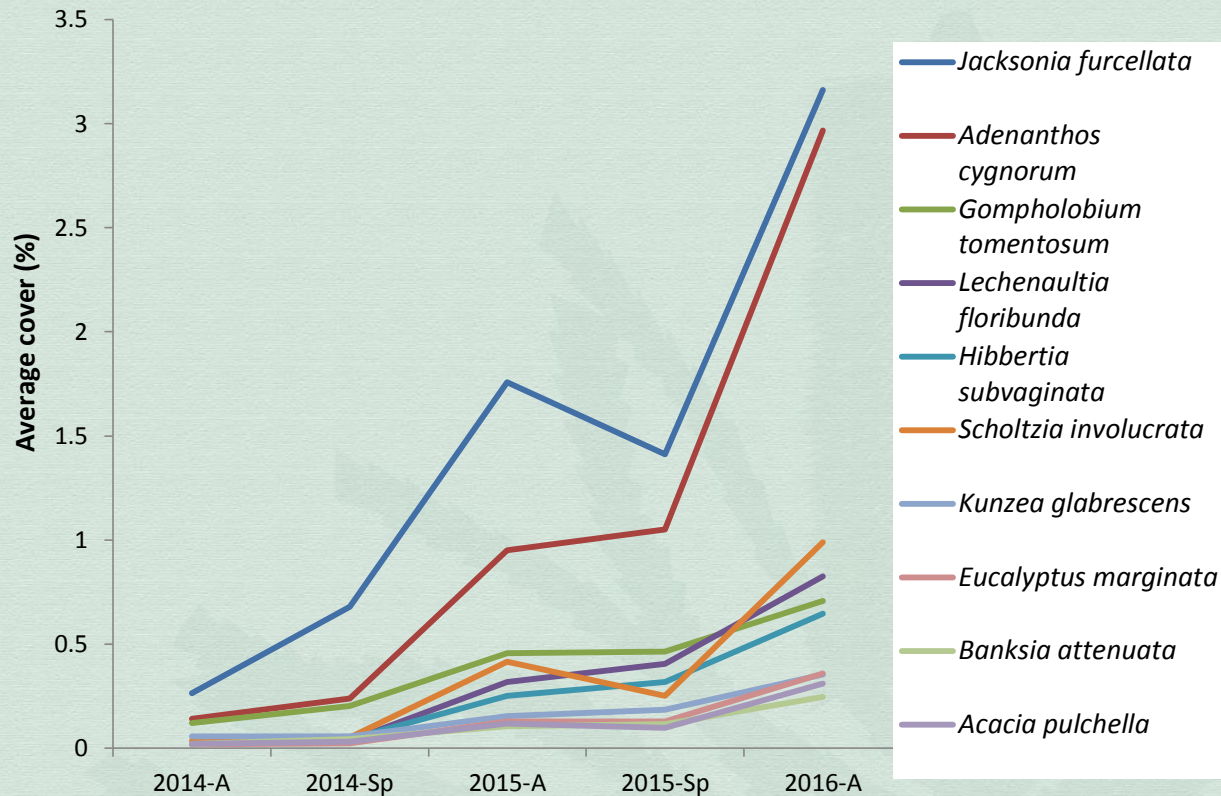
Restoration Outcomes: Dominant Species



Graph for top 10 native plants by density. This is dominated by *Jacksonia furcellata* and *Adenanthos cygnorum* – disturbance opportunists from topsoil.

Annual plant cover is initially dominated by weeds and *Podotheca gnaphalioides*, a native disturbance opportunist.

Restoration Outcomes: Abundant Species



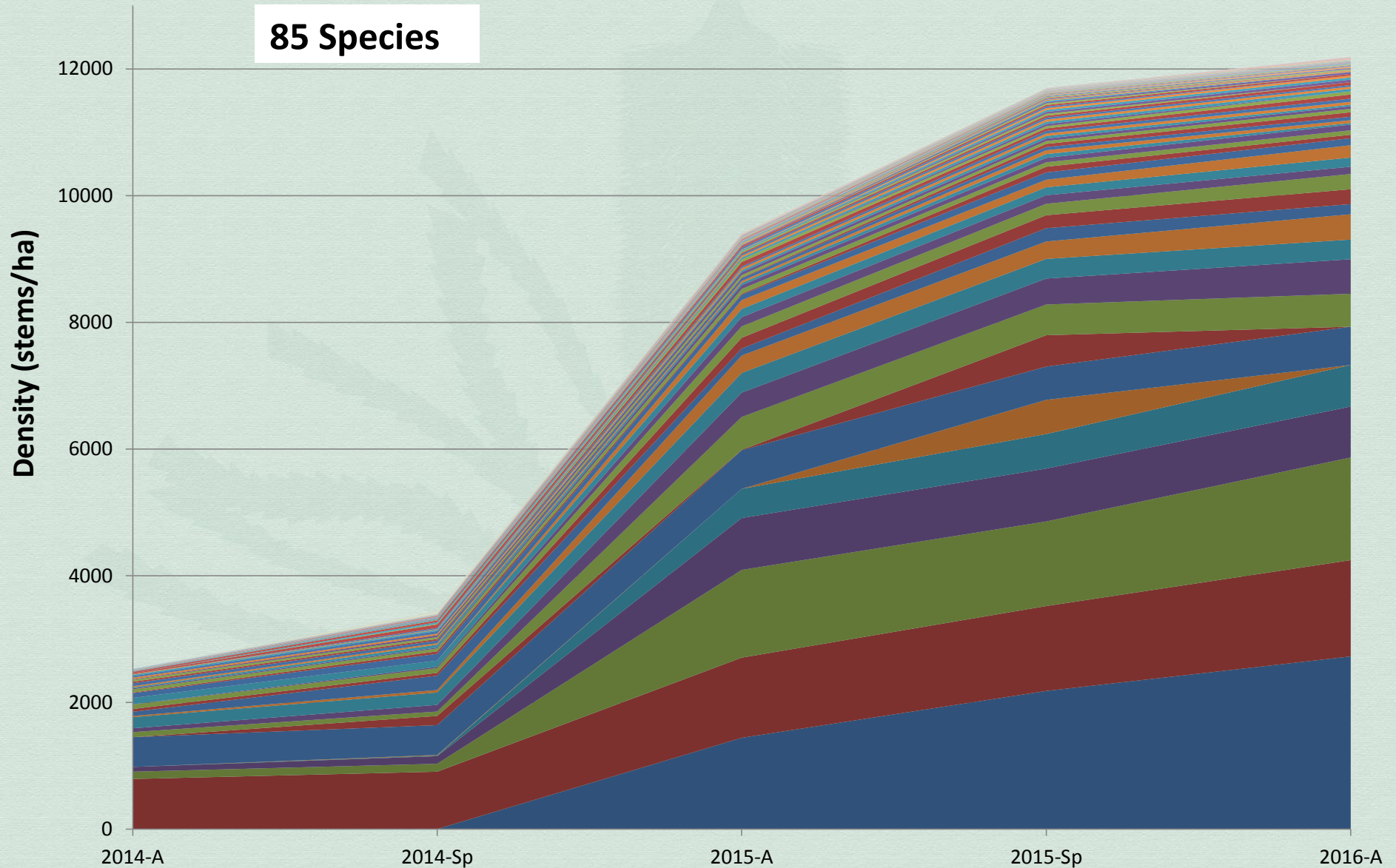
Podotheca gnaphalioides



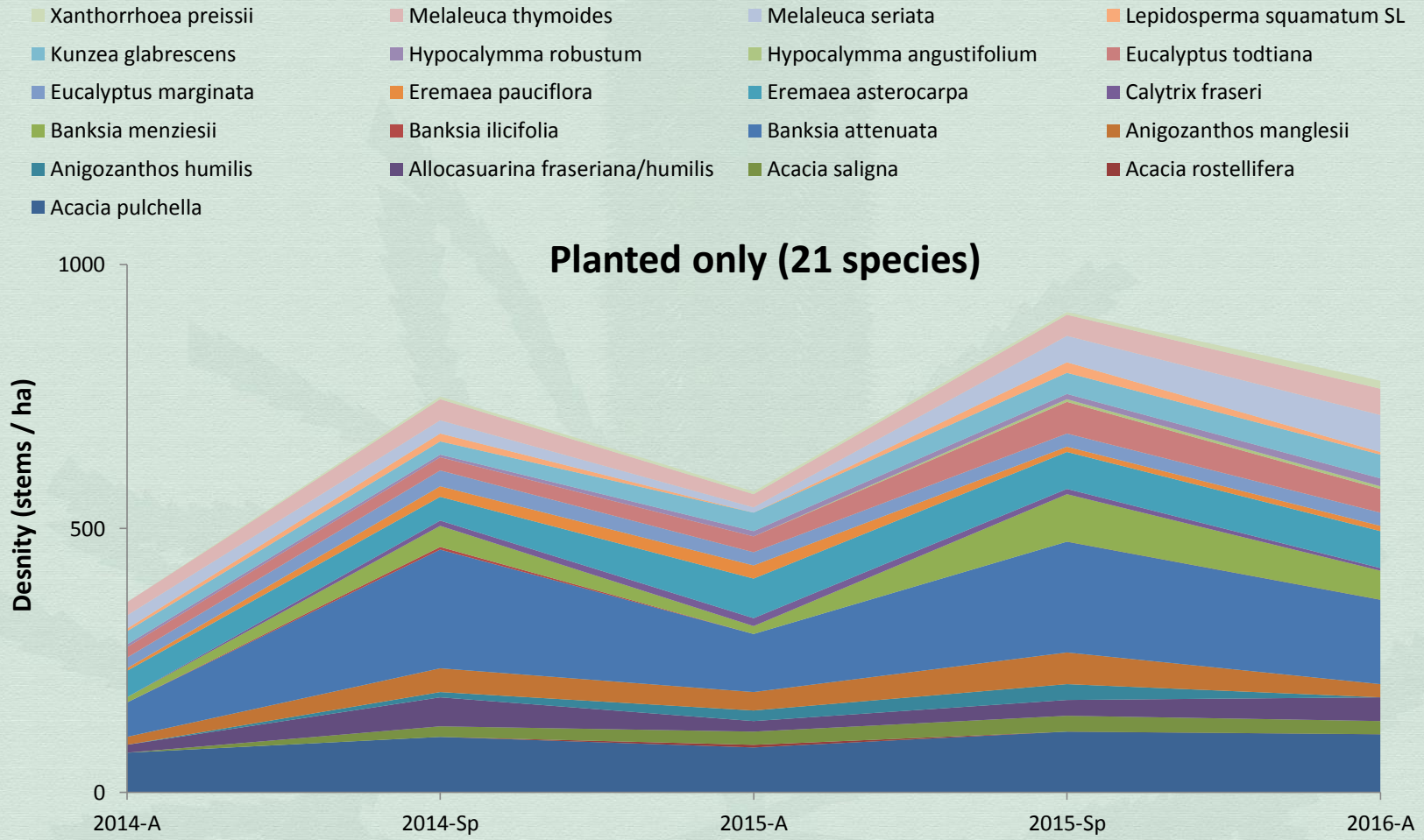
Graph for top 20 native plants by cover. This is dominated by small plants such as *Laxmania* spp. and *Gompholobium tomentosum* – disturbance opportunists from topsoil.

Larger shrubs and trees are also present in substantial numbers due to planting and seeding.

Restoration with Topsoil and Planting



Planted Species Only



Restoration Outcomes: Completion Criteria

Criteria	Target	Status in late 2015*
Total species richness	Maximise native species richness (there were >80 species present in reference quadrats)	160 native species (highly variable spatially)
Average species richness per 10 x 10 m quadrat	Return 60% of average number of native species recorded in reference quadrats (19 species).	14 to 30 species per quadrat (average 24)
Tree diversity	Presence of all trees at reference plots (<i>Adenanthos cygnorum</i> , <i>Banksia attenuata</i> , <i>B. ilicifolia</i> , <i>B. menziesii</i> , <i>Eucalyptus marginata</i> , <i>E. todtiana</i> and <i>Nuytsia floribunda</i>)	All present and many are >1 m tall
Tree density	Establish at least 300 stems per ha	428 per ha (before summer)
Carnaby's cockatoo food plants	This consists primarily of banksias - 250 stems per ha	290 per ha (banksia only)
Understory species richness per 10 x 10 m	Return 60% of average number of native understory species in reference quadrats (17 species).	14 to 28 native species per plot (average 22)
Total density of native perennial plants	Establish 7,000 stems per ha	4,000 - 22,000 stems per ha (average 13,000)
Annual native plants	No target set and very much lower in reference sites	>500,000 per ha
Key understory species	Separate targets set for top 10 most important species from reference plots	Most are common, but some are rare
Weed cover	Manage serious weeds, especially perennials, monitor annual weeds and manage if necessary	Perennial weeds effectively managed, annual weeds are common

* Data are for areas with topsoil and are lower elsewhere